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Education

Ph.D. 1988, Purdue University, Department of Agricultural Engineering. Dissertation: *An artificial intelligence approach to soil erosion modeling.*

M.S. 1985, University of Illinois, Department of Agricultural Engineering. Thesis: *Crop coefficients for irrigation scheduling in Illinois.*

B.S. 1984, University of Illinois, Department of Agricultural Engineering.

Professional Positions

Interim Director, Purdue University Discovery Park Center for the Environment (July 2005-September 2006)

Head of ABE, Purdue University (May 2005-present)

Interim Head of ABE, Purdue University (August 2004-May 2005)

Professor, Purdue University (1996-present)

Research Engineer, Sabbatical Leave at NASA Kennedy Space Center (KSC), KSC, FL and US Army Construction Engineering Research Laboratory, Champaign, IL (1994-95)

Associate Professor, Purdue University (1992-1996)

Assistant Professor, Purdue University (1988-1992)

Awards and Honors

State Scholarship, Illinois, 1980-1984

Johnathan Baldwin Turner Scholarship, 1980-1984

School of Agriculture Fellowship, University of Illinois, 1984-1985

USDA National Needs Fellow, 1985-1988

ASAE Educational Aids Blue Ribbon Award, *Dam Site Selection Expert System*, 1987

ASEE NASA Summer Fellow, Kennedy Space Center, Florida, 1992-1993

Professional Engineer (PE) (Indiana), 1995-present

ESCOP/ACOP Leadership Fellow, 1996-1997

Engineering Best Teacher Award, Agric. and Biological Engineering, Purdue University, 1996

School of Agriculture Outstanding Researcher, Purdue University, 1998

University Scholar, Purdue University, 1999-2003

ASAE Outstanding Young Researcher Award, 1999

Horwood Critique Honorable Mention Prize for 1999, 2001 and 2002 from the Urban and Regional Information Systems Association (URISA) for GIS and Hydrologic/Water Quality Modeling Papers

Outstanding Graduate Educator, College of Agriculture, 2006

ADMINISTRATIVE AND LEADERSHIP EXPERIENCE
Head and Interim Head of ABE
Dr. Engel served as Interim Head of ABE from August 2004-May 2005 and has served as Head since May 2005. This has provided an opportunity to lead a large ABE program and rapidly gain administrative and leadership experience at the departmental level. Although the duration has been relatively short, the experience has provided opportunities to deal with the management and leadership aspects of running a department including personnel conflict resolution, department budget management, faculty recruitment, faculty promotion, faculty and departmental advocacy, and development.

Education and Research
The management of Dr. Engel's education and research programs has required him to develop effective administrative and leadership skills. The magnitude of these programs has required that he adopt a leadership and management approach. He has also worked successfully as part of leadership teams in building his education and research program. In research efforts, he has worked closely with co-investigators and sponsors, typically employing a leadership team approach. He has also completed the one-year ESCOP/ACOP leadership program that helps develop leadership skills in land grant faculty.

ABE Graduate Committee
Dr. Engel served as the chair of the ABE graduate committee from 1996 through August 2004. In this role he helped establish additional graduate level courses, improve the quality of incoming graduate students as measured by GREs and GPAs, recruit students, increase the number of minority graduate students, and provide administrative support for other ABE graduate program activities. An emphasis was placed on working closely with faculty to recruit quality students. The ABE graduate program is ranked one of the top two graduate programs in this area in the US by the US News and World Report.

Earth Observation Systems Graduate Program
Dr. Engel is a founding member of the joint graduate Earth Observation Systems program with the University of Leuven in Belgium. Students from Purdue and University of Leuven spend the fall semester at Purdue in a common set of courses (including one of Engel's courses), the spring semester at Leuven in a common set of courses and then complete their research at either Purdue or Leuven. Dr. Engel currently serves as the Purdue director of the program.

ABE Strategic Plan
Dr. Engel provided leadership for the development of the ABE strategic plan. Input from faculty, staff, students, alumni and stakeholders was obtained to create the plan. The plan was published in 2004 and now serves as a roadmap for the Department.

University Committees
In recent years Dr. Engel has played an active role in several university committees. He served on the PUCC (Purdue University Computing Center) Review Committee that completed an in-depth

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review of PUCC and provided extensive recommendations. The recommendations included major upgrades to Purdue's research computing infrastructure and the creation of a new Vice President for Information Technology. He served on two committees that were formed to act on these recommendations (Research Computing and Communication Resource Committee and search committee for Vice President of Information Technology).

The Research Computing and Communication Resource Committee was instrumental in obtaining funds for the current Purdue supercomputer (ranked the third most powerful university supercomputer in the US when it was obtained). The committee also obtained recurring funding for support personnel to facilitate use of the supercomputer.

The university Research Incentives Committee provided recommendations for the creation of various incentive programs that would serve as encouragement to faculty to seek external grants and contracts. Recommendations from this effort have been implemented and others are currently being considered for implementation by the president.

Dr. Engel was a member of the search committee for the Dean of Engineering. He currently serves on two faculty cluster hire search committees – the climate change cluster that includes the School of Science and the School of Agriculture and the global sustainable industrial systems cluster that includes the Schools of Engineering, School of Science and School of Veterinary Medicine. More recently he served on the Dean of Agriculture Search Committee.

Dr. Engel currently serves on the three member committee appointed by the provost to coordinate the review of and provide recommendations on Purdue's environmental programs. The committee organized the external review of the environmental programs during May, 2003 and has since developed a plan for the re-organization of Purdue's environmental research and educational programs.

Center for Advanced Applications of GIS (CAAGIS)
CAAGIS (http://pasture.ecn.purdue.edu/~caagis/) was established approximately 5.5 years ago by Dr. Engel. CAAGIS grew out of Dr. Engel's education, research and outreach efforts associated with GIS. An academic reinvestment proposal allowed the expansion of GIS efforts through the creation of CAAGIS. CAAGIS has become very successful in serving the needs of faculty, students, staff and the public.

CAAGIS has hosted several international visiting scientists and two Purdue faculty completing Study in a Second Discipline programs. These efforts have helped establish continued education and research relationships. CAAGIS provided training to approximately 25 Cooperative Extension Service (CES) staff in 2000. CAAGIS is also assisting CES staff with the application of GIS to various issues faced in the field.

CAAGIS personnel have assembled GIS databases for Indiana and numerous other locations. These databases are widely used by faculty, students and staff on campus and by government agency personnel and other members of the public. CAAGIS personnel also provide guidance on the application of GIS within numerous research projects.

ABE Computing
The Purdue University Agricultural and Biological Engineering (ABE) Department has long been recognized as one of the nation's leading ABE departments in the use of computing for both undergraduate and graduate education and in research. Dr. Engel has been instrumental in obtaining external support for ABE computing. He has worked closely with Sun Microsystems, Intel and others in providing computing facilities and computational applications.

EXCELLENCE IN RESEARCH
Statement of Research Contribution
Dr. Engel has attained national and international stature in the field of information systems, focusing on the use of geographic information systems (GIS), expert systems, artificial intelligence and simulation to study and control agricultural non-point source pollution of surface and ground water. Dr. Engel was among the first to seize the opportunity presented by affordable workstation computers capable of displaying high resolution images and powerful enough to quickly model large land areas. He realized that the integration of the two fields (information systems and hydrologic/water quality modeling) offered enormous potential, both in the laboratory and in the field to greatly improve the decision-making that affects our water resources. Previously, investigators were forced to spend a great deal of time, money and effort in preparing the input spatial data sets needed for a single run of a large model; consequently, these valuable models were largely unused. Dr. Engel has been a leader in the national effort to integrate GIS and information technologies with watershed modeling to produce very usable, very powerful tools that dramatically reduce preparation time from weeks and months to a matter of minutes. This has made these complex models practical for the first time in evaluating a research hypothesis, or a design decision. The work performed by Dr. Engel and his students has helped to shape an entirely new approach to water quality modeling, that of developing water quality models within the context of a GIS setting. This has enabled "basin-level" water quality modeling, which can help not only to prevent costly, ineffective regulations, but more importantly, target stringent protection toward the most vulnerable areas. These discoveries are now used by many researchers around the world and have been extended by other scientists to create modeling and decision support systems which are being used to evaluate water resources and water quality issues for the entire US.   His methodologies are widely used by other universities, by local, state and federal government agencies, including NASA's Kennedy Space Center, the US Army (Ft. Chaffee, Camp Shelby, Ft. Bragg, Ft. Campbell, Ft. Stewart, and Ft. Leonardwood), the USDA Natural Resources Conservation Service (NRCS), and the US EPA to improve and protect water resources. Within Indiana, his research results are routinely used to protect water resources by the NRCS, the Office of the Indiana State Chemist (OISC), Indiana Department of Natural Resources (IDNR), and Indiana Department of Environmental Management (IDEM). His programs are in use around the world, including Jamaica, Portugal, the Netherlands, Germany, India, England, Australia and Indonesia. In addition, personnel trained by Dr. Engel in Jamaica and Portugal are continuing the development of more site specific systems.

Dr. Engel is an extremely active project leader and key contributor to multi-disciplinary research within the School of Agriculture, Schools of Engineering, and Purdue University. He and his co-investigators have leveraged Purdue's investment in this research, obtaining more than $13.5 million in external support during the past 16 years. He has been most active within the Environmental Sciences and Engineering Institute (ESEI) programs involving the Laboratory for Applications of Remote Sensing (LARS) and the Water Resources Research Center (WRRC). His cross-disciplinary collaborations have been most significant with faculty from Agricultural Economics, Forestry and Natural Resources, Agronomy, Civil Engineering, Earth and Atmospheric Science, and Veterinary Medicine. Dr. Engel led the development of the geographic information systems (GIS) database for the interdisciplinary Indian Pine Natural Resources Field Station. Building on this success, he initiated an effort (Center for Advanced Applications of GIS - CAAGIS) within ESEI to promote multi-disciplinary research, teaching and outreach using spatial (GIS) data. The Indian Pine GIS data sets along with many others developed or obtained by Dr. Engel are made available to Purdue staff and students and to the public on a GIS compute-data server which serves as the primary repository of state, national and international spatial data at Purdue University, and is central to numerous classes and multi-disciplinary research efforts. Dr. Engel and his students have made the GIS accessible via the Internet to schools, local governments and other interested groups throughout Indiana.

This GIS server also shares integrated GIS and natural resources modeling tools (many of which were developed by Dr. Engel and his students) with researchers and practitioners throughout the State, the US and the world via the Internet (WWW). For example, the Long-Term Hydrologic Impact Assessment (L-THIA) model (http://pasture.ecn.purdue.edu/runoff/lthianew/) is widely used throughout the US and has been adopted by the International City/County Management Association (ICMA). The L-THIA system with WWW GIS and watershed delineation capabilities (http://pasture.ecn.purdue.edu/~watergen/) is widely used with US EPA Region 5 and is being increasingly used in TMDL analysis. The National Agricultural Pesticide Risk Analysis (NAPRA) system (http://pasture.ecn.purdue.edu/~napra/) is used within Indiana and the Midwest to create pesticide and nutrient management plans for agricultural watersheds. Most recently a web-based GIS and database application for the Indiana NRCS was developed to collect Environmental Quality Incentives Program (EQIP) applications (see demonstration site at http://pasture.ecn.purdue.edu/~eqip/ and http://pasture.ecn.purdue.edu/~eqip/e-score).

Professor Engel's research has provided significant benefits to Indiana. One of the major sources of ground water pollution within Indiana, and within the Midwest US, is nonpoint source (NPS) pollution resulting from agricultural production. Dr. Engel's efforts in modeling the vulnerability of ground water to potential pollutants have created a series of ground water vulnerability maps that are being used within the State's ground water protection State Management Plan. He developed and validated a unique technique that used models integrated with GIS to determine ground water vulnerability to agricultural NPS pollution. The results were evaluated using observed nitrate and pesticide contamination in well water data and were found to be far more accurate than previously accepted techniques. These maps estimated that approximately 25% of the State is highly susceptible to contaminants reaching ground water with over 75% of pesticide and elevated nitrate detections located within the portions of the State predicted to be most susceptible. As a result, the State's ground water monitoring effort was designed to place greater

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numbers of monitoring wells within the State's most susceptible areas and the numbers of wells in less vulnerable areas were reduced. This provided improved protection for the State's ground water and resulted in substantial savings to the State since the overall number of monitoring wells could be safely reduced. The ground water vulnerability maps are also being used within the State Management Plan to target ground water educational efforts to areas with the most sensitive ground water. As a result of this pioneering research, regulations banning the use of certain pesticides within the State were not necessary. It also permitted the continued use of agronomic practices that maintain high levels of agricultural productivity in the less sensitive areas.

Dr. Engel recently developed a prototype research and decision support tool to estimate the risk of pesticides reaching ground and surface water at any location within the State, using site specific agronomic management information and extensive databases including GIS datasets. The tool is also unique in that it is WWW accessible allowing users to explore the effects of alternative management practices on the movement of pesticides to ground and surface water. It is currently being used by the Natural Resources Conservation Service (NRCS) within Indiana to target their water protection efforts.

Dr. Engel's research on runoff and water quality modeling within the Indian Pine watersheds led to the establishment of the Indiana Pilot Watershed Program. He developed models and decision support systems that can be applied to Indiana watersheds to estimate runoff, soil erosion and water quality. These modeling systems allow the selection of appropriate management and engineering practices to reduce the environmental threats posed by agriculture and other activities.

Publications
a. Refereed Journal Papers
1. Engel, B.A., W.D. Lembke, S.K. Sipp, and W.D. Goetsch. 1989. Irrigation crop coefficients for Illinois corn. Trans. ASAE. 32(4):1275-1280.
2. Engel, B.A., D.B. Beasley, and J.R. Barrett. 1990. Integrating multiple knowledge sources. Trans ASAE. 33(4):1371-1376.
3. Rewerts, C., B. Engel, J. Rogers, and D. Jones. 1990. An end user interface for CLIPS. AI Applications in Natural Resources. 4(2): 57-65.
4. Engel, B.A., D.B. Beasley, and J.R. Barrett. 1990. Integrating expert systems with conventional problem solving techniques using blackboards. Computers and Electronics in Agriculture. 4(4):287-302.
5. Motz, D., K. Haghighi, and B. Engel. 1990. A blackboard architecture for multiple knowledge source integration in a design environment. AI Applications in Natural Resources. 4(2): 101-109.
6. Engel, B.A., C. Baffaut, J.R. Barrett, J.B. Rogers, D.D. Jones. 1990. Knowledge transformation. Applied Artificial Intelligence. 4:67-80.
7. Wright, J.R., S. Benabdallah, and B.A. Engel. 1990. A normalized user interface for complex simulation models. AI Applications in Natural Resources. 4(2):11-16.

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8. Amin Sichani, S. and B.A. Engel. 1990. Prediction of runoff and sediment from agricultural watersheds by a mathematical model: Watershed simulation. Iran Agricultural Research 9(1):1-16.

9. Amin Sichani, S., B.A. Engel, and E.J. Monke. 1990. Prediction of runoff and sediment from agricultural watersheds by a mathematical model: Sediment-bound and soluble phosphorus loadings. Iran Agricultural Research 9(2):75-100.

10. Stone, N.D. and B.A. Engel. 1990. Knowledge-based systems in agriculture and natural resources management. AI Magazine. 11(3):20-22.

11. Srinivasan, R., B.A. Engel, and G. Paudyal. 1991. Expert system for irrigation management (ESIM). Computers and Electronics in Agriculture. 36(3):297-314.

12. Engel, B.A., D.D. Jones, J.R. Wright, and S. Benabdallah. 1991. Selection of an expert system development tool. AI Applications in Natural Resources. 5(1):15-22.

13. Engel, B.A. and D.B. Beasley. 1991. DSS: A dam site selector expert system for education. ASCE Journal of Irrigation and Drainage Engineering. 117(5):774-783.

14. Zhuang, X., B.A. Engel, M. Baumgardner, and P. Swain. 1991. Improving classification of crop residues using digital land ownership data and Landsat TM imagery. Photogrammetric Engineering and Remote Sensing. 57(11):1487-1492.

15. Amin Sichani, S., B.A. Engel, E.J. Monke, J.D. Eigel, and E.J. Kladivko. 1991. Validating GLEAMS with herbicide and insecticide field data on a Clermont silt loam soil. Trans ASAE 34(4):1732-1737.

16. Srinivasan, R. and B.A. Engel. 1991. Effect of slope prediction methods on slope and erosion estimates. Journal of Applied Engineering in Agriculture 7(6):779-783.

17. Engel, B.A., D.D. Jones, and T.L. Thompson. 1992. Advanced information systems: Integrating expert systems with traditional computer-based problem solving techniques. AI Applications in Natural Resources 6(2):5-12.

18. Edan, Y., B.A. Engel, and G.E. Miles. 1993. Intelligent control system simulation of an agricultural robot. Journal Paper No. 13043. Journal of Intelligent and Robotic Systems 8:267-284.

19. Mitchell, J.K., B.A. Engel, R. Srinivasan, R.L. Bingner, and S.S.Y. Wang. 1993. Validation of AGNPS for small mild topography watersheds using an integrated AGNPS/GIS. Advances in Hydro-Sciences and Engineering. pp. 503-510.

20. Brown, S.J. and B.A. Engel. 1993. A comparison of GIS assisted simulated hydrologic response with actual storm event data. Advances in Hydro-Sciences and Engineering. pp. 511-517.

21. Engel, B.A., R. Srinivasan, J. Arnold, C.C. Rewerts, and S.J. Brown. 1993. Nonpoint source (NPS) pollution modeling using models integrated with geographic information systems (GIS). Water Science and Technology 28(3-5):685-690.

22. Pritchard, T., J.G. Lee and B.A. Engel. 1993. Reducing agricultural sediment: An economic analysis of filter strips versus micro-targeting. Water Science and Technology 28(3-5):561-568.

23. Mitchell, J.K., B.A. Engel, R. Srinivasan, and S.S.Y. Wang. 1993. Validation of AGNPS for small watersheds using an integrated AGNPS/GIS system. Water Resources Bulletin 29(5):833-842.

24. Srinivasan, R., and B.A. Engel. 1994. A spatial decision support system for assessing agricultural nonpoint source pollution. Water Resources Research 30(3):441-452.

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25. Srinivasan, R., B.A. Engel, J.R. Wright, J.G. Lee, and D.D. Jones. 1994. The impact of GIS-derived topographic attributes on the simulation of erosion using AGNPS. Applied Engineering in Agriculture 10(4):561-566.

26. Zhuang, X., B.A. Engel, D.F. Lozano-Garcia, R.N. Fernandez, and C.J. Johannsen. 1994. Optimization of training data required for neuro-classification. International Journal of Remote Sensing 15(16):3271-3277.

27. Hetzroni, A., G.E. Miles, B.A. Engel, P.A. Hammer, and R.X. Latin. 1994. Machine vision monitoring of plant health. Advanced Space Research 14(11):203-212.

28. Embleton, K., B.A. Engel, and D.D. Jones. 1994. Evaluation of a Farmstead Drinking Water Quality Decision Support System. Applied Engineering in Agriculture. 10(6):863-869.

29. Zhuang, X., B.A. Engel, X. Xiong, and C.J. Johannsen. 1995. Analysis of classification results of remotely sensed data and evaluation of classification algorithms. Photogrammetric Engineering and Remote Sensing. 61(4):427-433.

30. Savabi, R., D.C. Flanagan, B. Hebel, and B.A. Engel. 1995. Application of WEPP and GIS-GRASS to a small watershed in Indiana. Journal of Soil and Water Conservation. 50(5):477-483.

31. Ozer, N., B.A. Engel, and J.E. Simon. 1995. Fusion classification techniques for fruit quality sorting. Trans. of ASAE 38(6):1927-1934.

32. Engel B., Randhir T., Lee J. 1995. A distributed parameter/GIS approach to reduce agricultural pollution. AM J AGR ECON 77: (5) 1358-1358.

33. McCauley, J.D. and B.A. Engel. 1995. Comparison of scene regenerations: SMAP, ECHO, and Maximum Likelihood. IEEE Trans. on Image Proc. 33(6):1313-1316.

34. Engel, B.A., K. Navulur, B. Cooper, and L. Hahn. 1996. Estimating groundwater vulnerability to nonpoint source pollution from nitrates and pesticides on a regional scale. IAHS Publication No. 235:521-526.

35. Muttiah, R.S., B.A. Engel, and D.D. Jones. 1996. Waste disposal site selection using GIS-based simulated annealing. Computers & Geoscience 22(9):1013-1017.

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37. Engel B., Lalor G.C., Vutchkov M.K. 1996. Spatial pattern of arsenic and lead distributions in Jamaican soils. ENVIRON GEOCHEM HLTH 18: (3) 105-111.

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39. Embleton, K., D. Jones and B. Engel. 1996. Comparative risk assessment primer. Environmental Software 11(4):203-207.

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41. Montas, H., J. Eigel, B. Engel, and K. Haghighi. 1997. Deterministic modeling of solute transport in soils with preferential flow pathways - Part 1. Model development. Trans. of ASAE 40(5):1245-1256.

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51. Pandey, S. S. Muthukrishnan, B. Engel and J. Harbor. 1999. Assessing the long-term impact of urban sprawl on runoff and non-point source pollution - a practical Geographical Information Systems (GIS) based method. URISA Proceedings. Horwood Critique Honorable Mention Prize for 1999 from the Urban and Regional Information Systems Association (URISA).

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Singh, R. (Ed.), Urban sustainability in the context of Global Change. Science Publishers, Inc., Enfield, New Hampshire. pp. 247-259.

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103. Arabi, M., J. R. Frankenberger, B. A. Engel and J.G. Arnold. 2007. Representation of agricultural conservation practices with SWAT. Hydrol. Process. (2007), DOI: 10.1002/hyp.6890.

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105. Miller, P. S., R. H. Mohtar, and B. A. Engel. 2007. Water quality monitoring strategies and their effects upon mass load calculation. TRANS of ASABE 50(3):817-829.

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107. Arabi, M., K. Abbaspour, R. Srinivasan, J. Frankenberger, B. Engel. 2007. Sensitivity Analysis for Identification of the Swat Model Structure. Hydrological Sciences (Accepted).

108. Thomas, M., B. Engel, M. Arabi, T. Zhai, R. Farnsworth, J. Frankenberger. 2007. Evaluation of nutrient management plans using an integrated modeling approach. TRANS of ASABE 23(6):747-755.

109.   Gaffer, R., D. Flanagan, M. Denight, B. Engel. 2008. Geographical information system erosion assessment at a military training site. Journal of Soil and Water Conservation 63(1):1-10.

b. Refereed Book Chapters

1. Engel, B.A., R. Thieme, A.D. Whittaker. 1989. Knowledge representation and reasoning. Chapter 5, In: J.R. Barrett and D.D. Jones (eds.), Knowledge Engineering in Agriculture, ASAE Monograph, ASAE, St. Joseph, MI. p.47-76.
2. Rhykerd, R.L., L.M. Rhykerd, B.A. Engel, C.L. Rhykerd Jr., and C.L. Rhykerd. 1991. Knowledge engineering for management of *Medicago sativa L.* In: Advances in Agronomy. Compilers International. Trivandrum, India, pp. 61-70.
3. Engel, B.A., R. Srinivasan, and C. Rewerts. 1993. A Spatial Decision Support System for Modeling and Managing Agricultural Non-Point Source Pollution. In: Environmental Modeling with GIS, M.F. Goodchild, B.O. Parks, and L.T. Steyart (Eds.), Oxford University Press, New York, NY, pp. 231-237.
4. Engel, B.A. and K. Navulur. 1997. The Role of Geographical Information Systems in Groundwater Engineering. In: Groundwater Engineering, J. Delleur (Ed.), McGraw Hill. pp.21-1 – 21-16.
5. Pandey, S., J. Harbor and B. Engel. 2000. Internet Based Geographic Information Systems and Decision Support Tools. URISA, Park Ridge, IL, 36 p.
6. Mohtar, R.H. T. Zhai, J-Y Choi, and B. Engel. 2005. Web-based GIS Hydrologic Modeling for Siting Water Harvesting Reservoir. In: Watershed Management in Dry Areas, Challenges and Opportunities. Eds. Bruggeman, A., M. Ouessar, and R. H. Mohtar. ICARDA Press. Alleppo Syria.
7. Engel, B.A., K.J. Lim and K. Navulur. 2006. The Role of Geographical Information Systems in Groundwater Engineering. In: Groundwater Engineering, J. Delleur (Ed.), Second Edition. CRC. pp.30-1 – 30-17.

c. Conference Proceedings
Professor Engel has authored or co-authored 54 papers for the proceedings of 37 national and international conferences.

d. Research Papers Distributed and Presented at National and International Meetings
Professor Engel has authored or co-authored more than 121 papers that have been presented and distributed at national and international meetings.

Graduate Students Advised
Professor Engel has served as major professor for 34 graduate students and currently serves as major professor for 4 graduate students. His former students hold various positions including research engineers in federal laboratories, engineers in consulting firms, research scientists/engineers in industry, manager of a watershed management district and professors at universities. He has also significantly influenced the graduate education of many other graduate students having served on more than 90 graduate advisory committees. Professor Engel has served on graduate advisory committees for students from Agronomy, Forestry and Natural

Resources, Agricultural Economics, Animal Science, Entomology, Horticulture, Civil Engineering, and Earth and Atmospheric Sciences.

Research Grants
Professor Engel and his co-investigators have obtained more than $17.6 million in support of his research efforts in the past 19 years through more than 115 grants. He has been especially successful in obtaining support from federal agencies including US EPA, USDA, NSF, USGS and NASA.

EXCELLENCE IN TEACHING
Dr. Engel's teaching contributions have been very significant, both on- and off-campus: he has updated and revised existing courses, developed new courses, and taught special topics courses and workshops. Much of his impact has been in GIS science, expert systems, modeling and teaching how to apply such knowledge to solving natural resources and environmental problems. Not only is he introducing state-of-the-art subject materials to undergraduate, graduate and adult students, he is also developing new pedagogical techniques, e.g., interactive digital multi-media learning modules. While on sabbatical leave at the NASA Kennedy Space Center in 1994, he taught his ABE 565 (Agricultural Systems Engineering) class over the Internet. In 2000, 2001, and 2002 he taught ABE 526 (Watershed Systems Design) through Web-based materials to students in Europe. He has developed Web-based environmental modeling tools that have proven very effective for educational uses.

Dr. Engel is a founding member of the joint graduate Earth Observation Systems program with the University of Leuven in Belgium. Students from Purdue and University of Leuven spend the fall semester at Purdue in a common set of courses (including one of Engel's courses), the spring semester at Leuven in a common set of courses and then complete their research at either Purdue or Leuven.

Dr. Engel has developed or assisted with the development of more than 75 computer-based multimedia programs for educational use primarily in the areas of environmental and soil and water resources protection (see http://www.epa.gov/glnpo/seahome and http://pasture.ecn.purdue.edu/~epados/). The hypermedia paradigm for these programs enables them to be used by federal and state agencies, for college classes and for students in junior and senior high school. These programs are widely distributed on CD and via the WWW. EPA Region 5 personnel estimate that over 50,000 of these multimedia programs have been requested and are in use by individuals around the globe. Many of the multimedia/hypermedia programs have been used to teach ASM 336, Environmental Systems Management, a new course developed by Dr. Engel. Approximately one-half the course lectures in this class were replaced by programs developed by Dr. Engel. Testing of these multimedia programs by Dr. Engel has shown that they are as effective as lectures and that such programs maintain their effectiveness even when extensive use of such modules is made, such as in ASM 336.

Dr. Engel has taught several workshops on the development of multimedia applications and computer-assisted instruction including two one-week workshops in Indonesia and a one-week

workshop in Puerto Rico. He currently serves on the advisory board for a European effort to develop extensive distance education materials related to geographic information systems (GIS).

Courses Taught Recently
The courses that Dr. Engel has taught in each of the last 3 years are briefly described below. In prior years he taught Soil and Water Conservation Engineering (design of grassed waterways, terraces, surface and subsurface drainage systems, and irrigation systems), Soil and Water Management, and Agricultural Systems Engineering.

ASM 215 Introduction to Surveying, Class 2, Laboratory 3, cr. 3.

ASM 336 Environmental Systems Management, Class 3, cr. 3, Various rural environmental issues of importance to agriculture including agri-business. Management and problem solving that involve environmental considerations. http://pasture.ecn.purdue.edu/~engelb/asm336

ABE 526 Watershed Systems Design, Class 3, cr. 3, Hydrologic design of upland water management systems for erosion control, water utilization, and run-off control; examination of economic and legal factors; analysis and design of composite systems for agricultural watersheds. http://pasture.ecn.purdue.edu/~engelb/abe526 Also offered as ABE 526I in 2000, 2001 and 2002 for students in Europe.

ABE 590 GIS Project Design, Class 3, cr. 3, Development of GIS projects. Advanced GIS application. Programming of GIS tools to adapt them to meet project needs.

ABE 697 Graduate Seminar, Class 1, cr. 0.

EXCELLENCE IN SERVICE
Although Professor Engel does not have a formal extension appointment, he makes numerous outreach presentations and has conducted numerous workshops related to the application of environmental education software and decision support systems (described briefly in the research section of this document). In the last three years, he has made more than twenty outreach presentations on the application of web-based decision support tools including the L-THIA (Long-Term Hydrologic Impact Assessment) model, web-based watershed delineation, SEDSPEC, and NAPRA (National Agricultural Pesticide Risk Assessment). A significant base of users has been established for these tools; for example, L-THIA averages more than 800 user sessions per month.

University, School(s) and Department Service
1. Agricultural Engineering Computer Committee, 1988-present.
2. School of Agriculture Water Quality Initiative Committee, 1989-1991.
3. Purdue Water Resources Research Center Council, 1989-1990, 1992- present.
4. Engineering Environmental Research and Education Committee, 1992-1993.
5. School of Engineering Education Committee, 1990-1994.
6. Agricultural Engineering Graduate Committee, 1989-present. Chair 1996-present.

7. PUCC (Purdue University Computing Center) Review Committee, 1998-1999.
8. Research Incentives Committee (University Committee), 1999-2000.
9. Research Computing and Communication Resource Committee (University Committee), 1999-2001.
10. Vice President for Information Technology search committee, 2000-2001.
11. Engineering Dean search committee, 2000-2001.
12. Engineering Dean's advisory committee, 2002-present
13. Environmental review committee, 2003-present
14. Global sustainable industrial systems cluster search committee, 2003-presnet
15. Climate change search committee, 2003-present
16. Engineering computing network director search committee, 2003-present
17. Agriculture Dean search committee, 2004

Memberships in Professional Societies and Organizations

American Society of Agricultural Engineers (ASAE), 1987-present.
National Society of Professional Engineers (NSPE), 1987-present.
Soil and Water Conservation Society (SWCS), 1988-present.
American Society of Civil Engineers (ASCE), 1988-present.
Sigma Xi (honor society, scientific research), 1986.
Phi Kappa Phi (national scholastic honor society), 1986.
Alpha Epsilon (honor society, agricultural engineering), 1987.
Gamma Sigma Delta (honor society, agriculture), 1986.
Alpha Mu (honor society, agricultural systems management), 2003

Court Cases in Last Four Years in Which Engel Served as an Expert

State of Oklahoma vs. Tyson, et al. January and February 2008. Deposition and testimony at the Preliminary Injunction Hearing.

Current Billing Rate

State of Oklahoma vs Tyson, et al. $165/hr

Professional Service Activities

1. American Society of Agricultural Engineers (ASAE) KS-14: Knowledge Engineering Committee, 1987-90, 1992-present, Vice-Chair in 1989-90, Chair in 1990-91.
2. American Society of Agricultural Engineers (ASAE) KS-15: Simulation Committee, 1988-90.
3. American Society of Agricultural Engineers (ASAE) KS-16: Geographic Information Systems Committee, 1990-present, provided leadership in establishment of this new committee. Secretary 1992-93, Vice-Chair 1993-1994, chair 1995-1996.
4. American Society of Agricultural Engineers (ASAE) SW-215: Hydrologic Systems Committee, 1988-present.
5. American Society of Agricultural Engineers (ASAE) SW-225: Conservation Systems Committee, 1987-89.
6. S-211: Hydrologic/Water Quality Modeling of Sediment and Chemical Movement, Southern Region USDA Committee, 1988-91.
7. S-249: Hydrologic and Water Quality Modeling, Southern Region USDA Committee, 1992-1996, Co-wrote proposal to form committee.
8. S-273 Ecological and Water Quality Modeling, Southern Region USDA Committee, 1997-2002.
9. US EPA National Land Use Change Committee 1998-2000.
10. MUTATE GIS Distance Education Advisory Board, European Union, 1998-present.
11. Global Livestock Collaborative Research and Support Projects Program Advisory Committee, 2000-present.
12. US EPA Scientific Advisory Panel to the Food Quality Protection Act Implementation Team, 1999-present.